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# Life cycle environmental assessment of electric and internal combustion engine vehicles in China

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# Life cycle environmental assessment of electric and internal combustion engine vehicles in China

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## Abstract

Promoting electric vehicles (EVs) is an important measure to ensure energy security, improve air quality, and mitigate global climate change. However, the emission reduction impacts of EVs in China have been widely debated and the conclusions of existing studies are still controversial. In this study, we adopted the life cycle assessment (LCA) method to evaluate the carbon dioxide (CO<sub>2</sub>) and air pollutant emissions from the stage of vehicle production, vehicle use and vehicle end-of-life. We further compared the emissions of three types of passenger vehicles in China, including internal combustion engine vehicle (ICEV), plug-in hybrid electric vehicle (PHEV), and battery electric vehicle (BEV). Compared with ICEV, BEV and PHEV were found to reduce the emissions of CO<sub>2</sub>, VOCs, and NO<sub>x</sub>, but increase the emissions of PM<sub>2.5</sub> and SO<sub>2</sub>. These differences were primarily caused by EV's high fuel efficiency and high fuel consumption of ICEV. Additional findings indicate that the emissions of PM<sub>2.5</sub> and SO<sub>2</sub> of BEV were 2.6 and 2.1 times that of ICEV, respectively; and the emissions of PM<sub>2.5</sub> and SO<sub>2</sub> of PHEV were 1.8 and 1.5 times that of ICEV, respectively. Moreover, we found the emissions of PM<sub>2.5</sub> and SO<sub>2</sub> of EV will be higher than that of ICEV in high renewable energy scenario with higher biomass share if keeping the emission factor of electricity constant.

## Keywords

Electric vehicle; Carbon dioxide emissions; Air pollutants; Life cycle assessment; China